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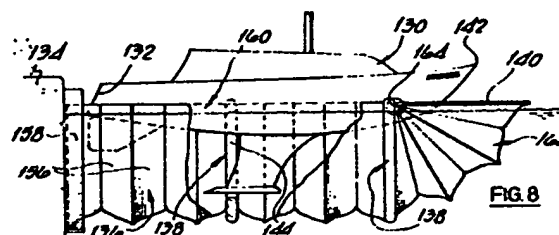
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(54) Method and apparatus for protecting water craft.

(57) A method of protecting a boat hull comprises deploying a protective envelope around the hull and treating the entrapped water to inhibit the action of marine organisms. When it is desired to use the boat, the envelope can be retracted to an unobtrusive position in which it occupies little space and its exposure to marine currents is minimal. Retraction and deployment is effected by folding a frame or support on which the envelope is mounted, and/or the envelope itself. During storage of the boat within the envelope, the entrapped water is tested by a probe and the amount of treatment agent needed to neutralise the marine life is determined. This precise amount is added to the entrapped water, whereby the latter is rendered neutral with respect to the hull and is likewise harmless environmentally when released upon retraction of the envelope.



EP 0 360 436 A1

## METHOD AND APPARATUS FOR PROTECTING WATER CRAFT

This invention relates to a method and apparatus for protecting water craft. More particularly, but not exclusively, the invention relates to a method of, and apparatus for, protecting the hulls of boats moored in salt water, thereby to eliminate or reduce the effect of marine organisms and other matter and dissolved materials within the water, which have a deleterious effect on boat hulls, such effect including the growth of barnacles etc. The invention is applicable not only to craft kept in salt water, but also to other environments.

The need for a means for protecting boat hulls has recently become more pronounced following the moves to restrict the use of certain paints and treatment materials which had hitherto been employed for inhibiting marine growth. Such materials are now either prohibited or else the permitted materials sold in their place are not as effective.

Many proposals have been made for the provision of means for protecting boat hulls. These include the concept of providing some means for surrounding the boat hull, while it is moored, and for treating the water surrounding the hull so that it is less injurious. While this general approach to a solution to the problem is thought to be the right one, prior proposals in this respect have certain serious shortcomings.

In US 3,205,851 (WISWELL) there is disclosed apparatus for enclosing the hull of a boat in water-proof flexible material and treating the enclosed water with an anti-fouling chemical such as chlorine tablets.

However, the disclosure in this prior specification is subject to the shortcoming that in commonly occurring marine situations, the sheet material envelope in which the boat is stored, is extremely susceptible to displacement by marine currents immediately after the boat has emerged from the open end of the envelope, as shown in Fig 2. Tests show that the envelope, thus deployed, will tend to act as a water-borne spinnaker, and will become uncontrollable. In any case, the envelope occupies significant water space when the boat is elsewhere, and at the very least may cause inconvenience for that reason. Further shortcomings of this prior proposal include the relatively inefficient means for sealing the envelope by mere binding together of the supports 19 (as shown in Fig 6) when the envelope is closed around a boat, and the problem of disposing of the treated water when the boat subsequently emerges. The water itself, after treatment, poses an environmental hazard, in view of the presence in it of excess quantities of the anti-fouling chemicals.

US 3,885,477 (WOOD) proposes a boat hull

protecting envelope supported on a framework in which ingress and egress of the boat is permitted by simply lowering a rear portion of the framework, and thus also of the envelope, so that a boat can float into the envelope over this submerged portion, which is then raised.

As will be appreciated from the discussion above, this prior proposal is also subject to susceptibility to marine currents, and space occupation considerations. Also, there is the other problem of how to dispose of the treated water after storage of the boat in it. In this latter regard US 1,973,813 (KELLY) proposes the use of an associated barge into which the treated water is pumped and is there further treated to render it fit for discharge. With regard to the susceptibility of the Wood proposal to marine currents, it will be noted that his proposal is for use in a marine dock defining a boat slip, and thus is not intended to be used where marine currents will be of any significance.

An object of the present invention is to provide a method and apparatus offering improvements in relation to one or more of the matters discussed above, or generally.

According to the invention there is provided a method and apparatus for protecting the lower portion of a water craft, as defined in the accompanying claims.

In a preferred embodiment a method of protecting a lower portion of a water craft comprises providing a protective envelope around said lower portion of the water craft, and thereby entrapping water within the envelope. The entrapped water within the envelope is treated to reduce the action of organisms or matter contained therein. Subsequently, the water craft is removed from the envelope. This is permitted by the step of retracting the envelope from a deployed position around the lower portion of the water craft to a retracted position in which the exposure of the envelope to water currents is reduced.

In the said retracted position of the envelope, the latter may be either fully retracted so as to lie in a generally horizontal plane at or adjacent the water surface, or the envelope may be retracted so as to be in a generally vertical or upwardly extending plane, for example alongside a quay, for storage in a container or the like mounted on the quay.

Also in a preferred embodiment, the step of retracting the envelope is performed by folding same. The envelope is mounted on a support, and the support is folded about an axis transverse to the fore/aft axis of the boat. Alternatively, the support may be folded or hinged about an axis extending generally in or parallel to the fore/aft axis of the

water craft.

In a further preferred embodiment, a portion of the envelope is mounted on a foldable support and the step of retracting the envelope causes, initially, said support and the associated envelope portion to fold about an axis transverse to the fore/aft axis of the water craft, and then the remainder of the envelope folds in concertina fashion substantially in said fore/aft direction of the water craft.

A preferred embodiment of apparatus for protecting a lower portion of a water craft comprises a protective envelope of flexible sheet material to encompass the lower portion of the water craft. Support means is provided for the envelope, which is capable of supporting the envelope in surrounding relationship to a water craft, so as to entrap water, in use, between the envelope and the water craft. The support means is movably mounted to permit a portion of the envelope to be moved to permit arrival and departure of a water craft. The envelope and the support means are mounted so as to be extensible and retractable between a deployed position of the envelope in which the envelope encompasses said lower portion of the water craft, and a retracted out-of-use position in which the envelope and the support are folded with reduced exposure to water currents.

The support means comprises a generally U-shaped structure mounted for pivotal movement between a raised in-use position and a lowered position permitting arrival and departure of water craft. In one embodiment, the U-shaped structure provides support for one end portion of the envelope and another portion of the envelope forms a generally U-section channel extending lengthwise of the water craft in the deployed position of the envelope and which can fold lengthwise of the water craft in concertina fashion to reach the retracted position of the envelope. Generally U-shaped buoyancy members may be provided extending from one side to the other of said other portion of the envelope, to support same without a support frame.

In a further preferred embodiment, container means is provided to be secured to a quay or mooring platform to contain the envelope in its retracted position.

In one preferred embodiment, means for supporting the envelope comprises a generally U-shaped floating support structure. Frame members associated with this support means for the envelope may comprise plug-together frame elements.

A preferred embodiment of a method for protecting a lower portion of a water craft comprises providing a protective envelope around said lower portion, thereby entrapping water within the envelope. The entrapped water is treated to reduce

the action of organisms or matter contained therein. The water craft is subsequently removed from the envelope. The method the step of testing the entrapped water prior to the treatment thereof. The result of the test is used to determine the amount of treatment means to be added to the water. An amount of treatment means is added to the water so that, while the action of the organisms or the matter therein is reduced, the treated water is nevertheless fit subsequently to be released into the environment upon removing the water craft from the envelope. The step of testing may determine the amount of living matter contained in the water. The water within the envelope may be tested continuously or intermittently after initial treatment, and further amounts of the treatment means may be added as necessary.

Apparatus for performing the method comprises probe means for contact with the water to be tested, signal processing means connected to the probe means to analyse signals therefrom and to display the signals or to control means responsive to the analysed signals, to display a reading or to control treatment means dispensing apparatus in accordance with the measured content of the water tested.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:

Fig 1 shows, somewhat diagrammatically, a side elevation view of hull protecting apparatus according to the invention in its deployed condition;

Fig 2 shows, also diagrammatically, a transverse section through the apparatus of Fig 1, generally indicating the presence therein of a keeled boat;

Fig 3 shows, in a cross-sectional view similar to that of Fig 2, a further embodiment having a different cross-sectional profile to accommodate a generally rectangular sectioned and flat bottomed boat;

Fig 4 shows, diagrammatically, the method of securing the envelope material to the tubular material of the framework supporting the boat envelope;

Figs 5 shows, somewhat diagrammatically, a plan view of a further embodiment showing a boat located within a protective envelope;

Fig 6 shows a section through the embodiment of Fig 5, the direction of viewing being indicated in Fig 5 by arrow VI-VI;

Figs 7 and 8 show plan and side elevation views of a further embodiment; and

Fig 9 shows a section through a buoyancy member also seen in Figs 7 and 8.

As shown in Fig 1 apparatus 10 for protecting a boat hull (not shown) comprises a floating boom or support 12, frame means 14 and an envelope 16

mounted thereon. These main elements of the apparatus will now be discussed in turn.

Boom or support 12 is generally U-shaped in plan view having an open end 18 and a closed end 20. The support comprises lengthwise-extending buoyancy members 22, 24 containing a low density material such as polystyrene or the like. Inflatable members may also or alternatively be provided. The support 12 serves to carry the entire weight of the apparatus 10 in the water 26 in which it is located.

Frame means 14 comprises an assembly of three generally channel-shaped frame members 26, 28, 30, all mounted on support 12 for folding pivotal movement about an axis or axes in the region 32. The frame members are mounted below support 12 and are generally similarly channel-shaped in profile so as to conveniently locate below the support. Each of the frame members 26, 28, 30 comprises an assembly of plug-together frame elements 33 linked by tubular joints 34. Both tubes and joints may be of suitable plastics material or other non-corrodible material such as aluminium or stainless steel.

Frame member 26 has its own hinge assembly 36. Frame member 28 may likewise be connected thereto, or provided with its own hinge assembly. Frame member 30 is secured to the underside of support 12, and is thus not pivotable relative thereto.

It will be noted that no frame members are shown in the portion of the apparatus at the open end 18 of boom 12. Such frame members may be provided if deemed necessary for a given situation, but it is believed that they are not required in many applications.

Envelope 16 is a lightweight and strong synthetic sheet material which has been treated to resist fungal and marine growth. The anti-fungal materials are incorporated into the material of the sheet whereby it is unnecessary to periodically invert the sheet material as has hitherto been the case. For example, the sheet material may be PVC-coated polyester. Other anti-fungal and marine growthresistant materials may equally be used.

As shown in Fig 4, the envelope or membrane 16 is secured to the frame members 26, 28, 30 by short straps 38 of sheet material welded to the envelope. The loose connection thus effected serves to secure the envelope to the frame means 14 on the outer side thereof, so that (as described below) the frame is generally stored in water which has been treated to resist fungal and marine growth.

It is particularly to be noted that the envelope 16 extends, in its deployed condition shown in Fig 1, from end 18 to end 20 in a uniform and liquid-tight fashion, connecting to the support 12 at each

end, and likewise lengthwise of the support, so that the boat (not shown) within the envelope is entirely separated by this watertight enclosure from the untreated marine water outside.

Frame means 14 folds back, to its retracted position, at the end 20 of support 12 so as to underly the support at that end. In this condition, envelope 16 is folded concertina-fashion, between the frame members 26, 28, 30.

Retraction and deployment of the frame and envelope respectively is effected by means of lines 38, 40 secured thereto and associated guide loops 42 for the latter. In this way, the envelope 16 can be secured in its deployed or retracted position by a simple tying/securing operation, and then subsequently retracted or deployed by merely untying and applying tension to the relevant line so to unfold the frame and cause the envelope to be deployed below the frame and thus below the boat hull. It will be seen that the frame means ensures that the envelope is guided around the boat hull, thus containing the hull within it and separating it from the remainder of the sea water in a liquid-tight manner.

For the purpose of treating water located between envelope 16 and the hull of a boat during use, testing apparatus is provided to determine the content of the water in terms of the number of living organisms present in it, or other material requiring treatment, so that an exactly correct corresponding dose of treatment agent may be released into the entrapped water to render it neutral and non-damaging with respect to the hull, and subsequently, safe environmentally, when released into the surrounding water.

For this purpose, an electronic probe 44, (shown diagrammatically) is provided within the envelope, which passes an impulse reading via a cable 45 to a meter 46 indicating the quantities of chemical treatment material required to neutralise and render non-damaging the living matter and other agents and organisms present within the envelope's water. The signal from the meter then causes a parasteltic pump 47 to deliver to the envelope the correct amount of chemical treatment fluid via a delivery tube 48. The liquid within the envelope then remains inert until such time as further living organisms are able to enter it, whereupon these are sensed by the probe and the pump is reactivated.

In use, the apparatus 10 is floated on the water 26 in its retracted condition with the frame means 14 fully folded up below the support 12 at the closed end 20 thereof, with the envelope 16 likewise fully retracted and thus held in its condition where it offers substantially no resistance to marine currents. The boat then enters at the open end 18 of the boom or support, and frame 14 is released

and by suitable activation of lines 38 and 40, both the frame and the envelope 16 are deployed until the envelope reaches the end 18 of the apparatus, whereupon it is secured in a tight and thus smooth and hydro-dynamically low resistance configuration. The probe is caused to sense the content of the water entrapped, and the process of neutralising same then ensues as described above. The boat is stored within the envelope for the required period of time, and during this time the profile of the envelope is such that it offers hardly greater resistance to marine currents than the boat itself, and thus efficiently maintains the neutral marine environment for the hull of the boat while not adding significantly to the mooring or stability problems of the craft.

When it is desired to remove the boat from the apparatus, the relevant lines 38 and/or 40 are released, and by appropriate actuation of the lines, the frame is caused to fold rearwards together with the envelope, whereupon the boat is merely floating within a generally U-shaped boom, and is free to emerge from same without hindrance.

Figs 2 and 3 show modifications in which the shapes of the frame members 50 and 52 are adapted to accommodate craft having, respectively, a keel 54 and a flat bottom 56. Otherwise, these embodiments are constructed as described above.

Interestingly, the above embodiments provide the notable advantages that apparatus for protecting a boat hull is provided which has substantially reduced space requirements and susceptibility to marine currents when retracted, while nevertheless providing a watertight envelope around a craft when deployed, without requiring a watertight seal to be established between separable structures. The marine organism content of the entrapped water is determined and neutralised on an initial and continuing basis, and in a simple manner, while leaving the water in a condition for safe subsequent release into the environment.

In the embodiment of Figs 5 and 6, a boat 100 is shown moored at a quay side 102. Support means 104 and an envelope 106 are provided in a similar manner to the preceding embodiments, but in this case the assembly is mounted on the quayside instead of on a floating boom.

In this embodiment, the envelope 106 is secured at its lower end 108 to the quayside. Its upper end 110 is connected to support means 104 so as to be supported thereby, as more fully described below.

As shown in Fig 6, envelope 106 comprises a series of individual panels sewn or otherwise secured together, as shown, so as to be collapsible in concertina fashion. The envelope has a sufficient depth, as seen Fig 6, to accommodate a long downwardly extending keel structure 112 on the

boat 100. At the inner side of the envelope, the latter is secured to the quayside so as to describe a generally channel-shaped inner periphery of the mooring zone, the latter being defined at one side by the envelope 106, and the other by the quayside 102.

Thus, envelope 106 cooperates with the quayside to define a mooring zone which, in the Fig 6 configuration, is substantially liquid tight. The upper edge of the envelope is supported by support means 104. The latter may comprise a frame formed from frame members and joints similar to those described in the first embodiment. In the raised position of the frame shown in Figs 5 and 6, the frame is supported from the boat 100 by suitable tie means (not shown) extending between the outboard side of the boat and the frame.

Frame or support means 104 is mounted at its inner ends 114, 116 on quayside 102 for pivotal movement about a generally horizontal axis 118 between a raised position shown in Figs 5 and 6, and a corresponding lowered, out of use position, in which the frame lies in a generally vertical plane, below axis 118 and alongside the quayside 102.

A container 120, generally of U-shaped form is mounted on quayside 102 to receive the structure of support 104 and envelope 106, when these latter are retracted and lowered to their downwardly-extending position alongside the quayside. Container 120 is indicated only diagrammatically in Figs 5 and 6, and may comprise a suitable box or tube-like structure formed of, for example, a plastics or fibreglass material.

In operation, this embodiment functions in a manner very similar to that of the preceding embodiments, except that the boat 100 is moored at the quayside 102 initially, whereupon, by means of a suitable tie (not shown) or rod the support frame 104 and envelope 106 are raised, clearing the keel, and pivoting about axis 118 until they reach the position shown in Figs 5 and 6, whereupon the frame is secured by a tie to the outboard side of the boat, and mooring is complete. The water within the envelope can now be treated in the manner described previously.

Turning now to the embodiment of Figs 7, 8 and 9, it will be seen that in this case the boat 130 is moored at its stern 132 to the quayside 134. An envelope 136 is provided to encompass the lower portion of the boat, as in preceding embodiments. In this case however, the envelope is provided with support means 138 which comprises not only a frame 140 to support the end portion of the envelope, which extends around the bows 142 of boat 130, but also a pair of generally U-shaped buoyancy members 144, 146. These buoyancy members comprise a lightweight buoyant material such as polystyrene foam material. As shown in Fig 9,

the polystyrene foam 148 in the form of a rectangular section strip is contained within an envelope 150 of the same impermeable sheet material as the envelope 136, this envelope being formed by seam-welding two panels 152, 154, which may be substantially the same panels as are used for the envelope 136 itself.

As regards the main envelope 136, this comprises individual panels 156 joined edge-to-edge to form a bellows-like structure which can extend and retract in concertina fashion, as indicated in Figs 7 and 8. The in board end of envelope 136 is secured to quayside 134 with an associated container 158 corresponding to the container of the preceding embodiment, and which serves also to provide a housing for the water treatment equipment as described above in connection with the first embodiment.

Thus, the envelope 136 comprises a main generally U-section main portion 160 extending from quayside 134 up to the second buoyancy member 148, and followed by a forward portion 162 corresponding to the entire envelope of the preceding embodiment (though smaller since it has only to accommodate the bows 142 of boat 130) which can be raised and lowered by means of frame 140, by pivoting the latter about its transversely-extending pivot axis 164 between the raised position shown in Fig 7 and 8, and a lowered position (in which it is alongside buoyancy member 146) in which boat 130 can leave its moorings.

When the boat has left its moorings, the envelope assembly can be folded back into container 158. This latter action is achieved by a generally linear concertina-action in respect of envelope portion 160, after the angular folding action initiated by frame 140 on the envelope front portion 162.

Frame 140 is retained in its Figs 7 and 8 in-use raised-position by suitable tie means (not shown) connecting it to the bows 142 of the boat.

It is particularly to be noted that in this embodiment a substantial length of the envelope 136 (namely the portion 160 thereof) is not provided with a support frame corresponding to frame 140, but is simply supported by the buoyancy members 144 and 146. Likewise, in this embodiment, it is only the front portion 162 of the envelope which is pivoted downwards to permit arrival and departure of the water craft. The remainder of the envelope is collapsible in a bellows-like linear manner.

Treatment of the water within the envelope is effected as described previously.

This embodiment permits a boat to be moored at its stern while still obtaining the advantages provided by the other embodiments of the invention.

## Claims

1 A method of protecting a lower portion of a water craft (100, 130) comprising:

a) providing a protective envelope (16, 106, 136) around said lower portion of the water craft, thereby entrapping water within the envelope;

b) treating said entrapped water to reduce the action of organisms or matter contained therein; and

c) subsequently removing the water craft from the envelope; characterised by the step of

d) retracting said envelope (16, 106, 136) from a deployed position around said lower portion of the water craft to a retracted position in which the exposure of the envelope to water currents is reduced, in order to permit said removal of the water craft.

2 A method according to claim 1 characterised by said step of retracting the envelope being performed by folding said envelope in the manner of a bellows.

3 A method according to claim 2 characterised by said envelope being mounted on support means (12, 14; 104; 138, 140) and the method comprising folding said support means about an axis (164) transverse to the fore/aft axis of the water craft.

4 A method according to claim 2 characterised by said envelope (106) being mounted on a support (104) and the method comprising retracting said envelope by folding said support about an axis (118) extending in the fore/aft direction of said water craft.

5 A method according to claim 2 characterised in that said envelope (136) is mounted on a support (140) and said support is initially folded about an axis (164) generally transverse to the fore/aft direction of the water craft, the support and envelope then being folded in bellows or concertina fashion in the fore/aft direction of the water craft.

6 Apparatus for protecting a lower portion of a water craft comprising :-

a) a protective envelope (16, 106, 136) of flexible sheet material to encompass said lower portion of the water craft (100, 130);

b) support means (12, 14; 104; 138, 140) for said envelope and capable of supporting said envelope in surrounding relationship to a water craft so as to entrap water, in use, between the envelope and the water craft;

c) at least a portion (140) of said support means being movably mounted to permit at least, a portion (162) of said envelope to be moved to permit arrival and departure of a water craft (130); characterised in that

d) said envelope and said support means are movably mounted so as to be extensible and retractable between a deployed position of the en-

velope in which the envelope encompasses said lower portion of the water craft, and a retracted out-of-use position in which the envelope and the support are folded with reduced exposure to water currents.

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7 Apparatus according to claims 6 characterised in that said support means comprises a generally U-shaped structure (14, 104, 140) mounted for pivotal movement between a raised in-use position and a lowered position permitting arrival and departure of water craft.

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8 Apparatus according to claim 7 characterised in that said U-shaped structure (140) supports one end portion (162) of said envelope and another portion of the envelope forms a generally U-section continuation thereof extending lengthwise of the water craft in the deployed position of the envelope and which can fold in concertina or bellows fashion to produce the retracted position of the envelope.

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9 Apparatus according to claim 8 characterised by a generally U-shaped buoyancy member (138) extending from one side to the other of said other portion of the envelope, to support the envelope..

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10 A method of protecting a lower portion of a water craft comprising:

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a) providing a protective envelope (16, 106, 136) around said lower portion thereby entrapping water within the envelope;

b) treating said entrapped water to reduce the action of organisms or matter contained therein;

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c) subsequently removing the water craft (100, 130) from the envelope characterised by the steps of

d) testing said entrapped water prior to said treatment thereof;

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e) using the result of said test to determine the amount of treatment means to be added to said water; and

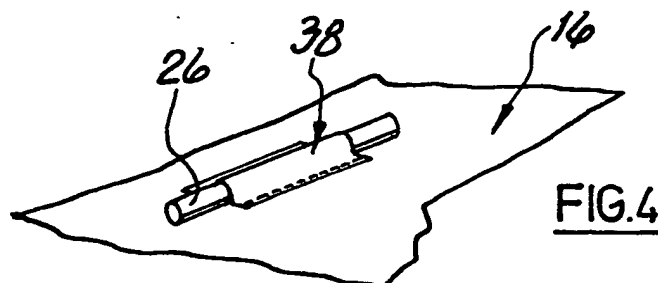
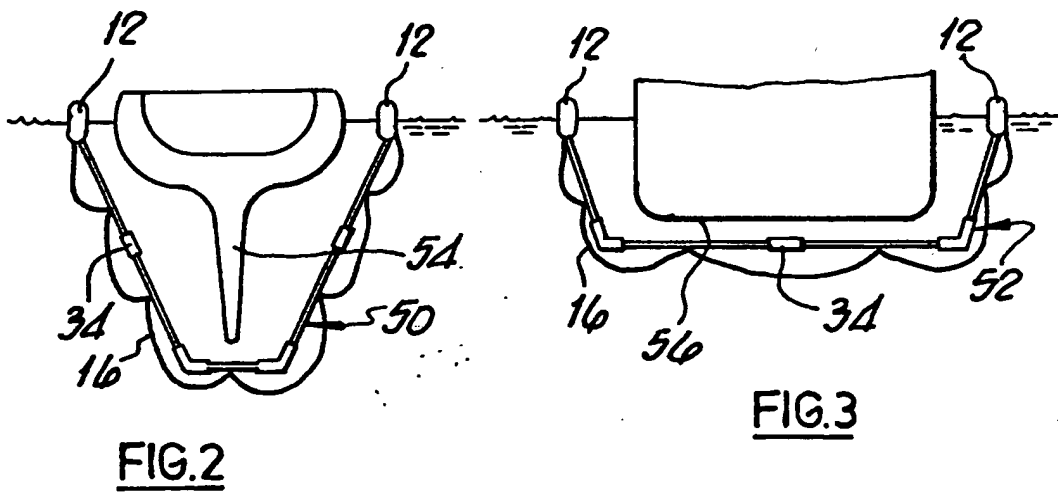
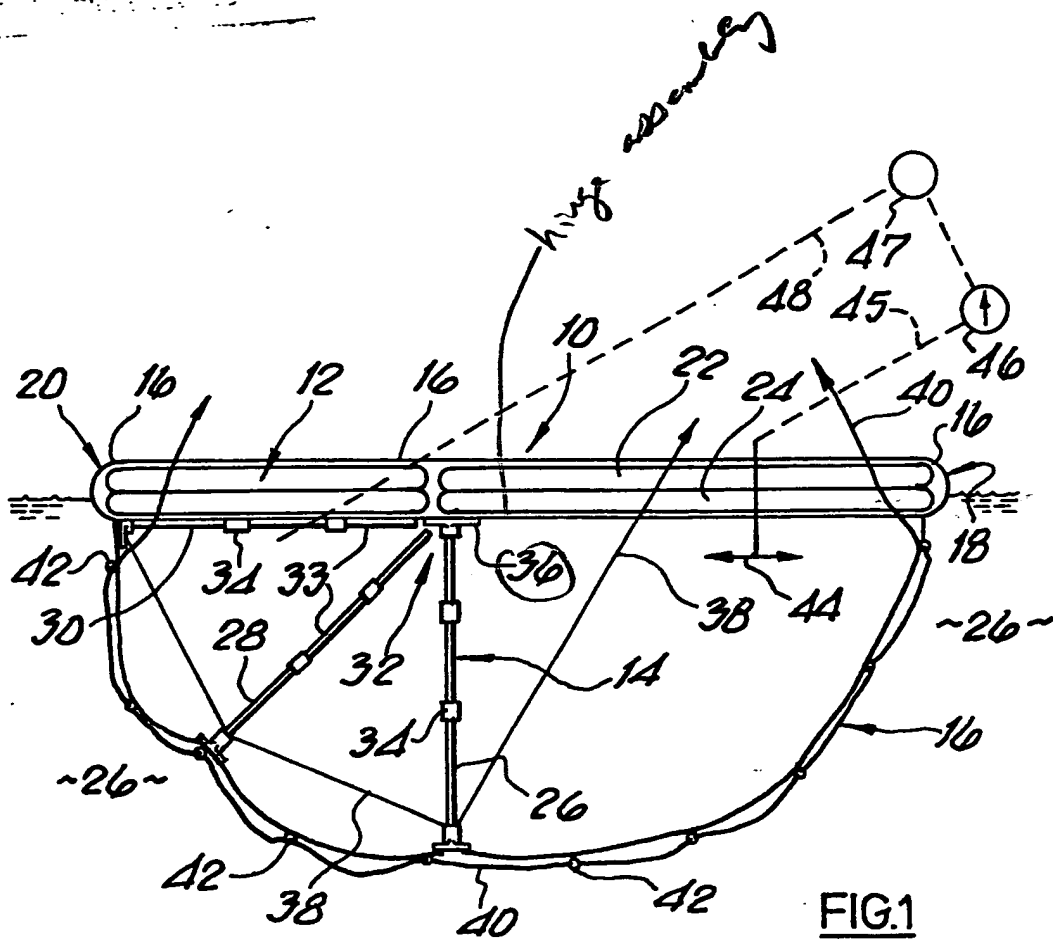
f) adding an amount of treatment means to said water so that while said action of said organisms or matter is reduced, the treated water is fit subsequently to be released upon removing the water craft from the envelope.

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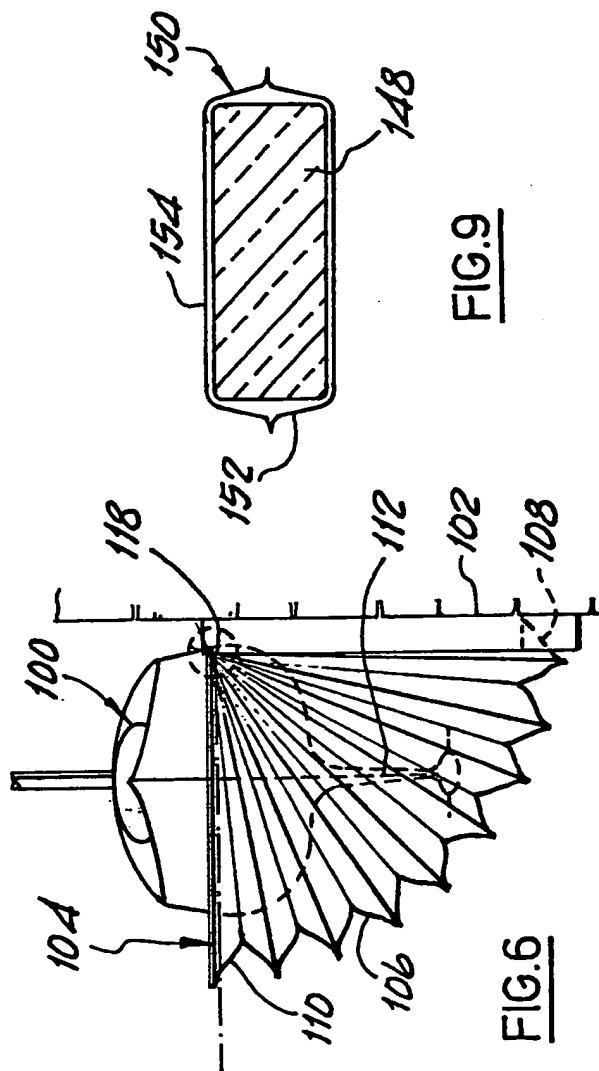
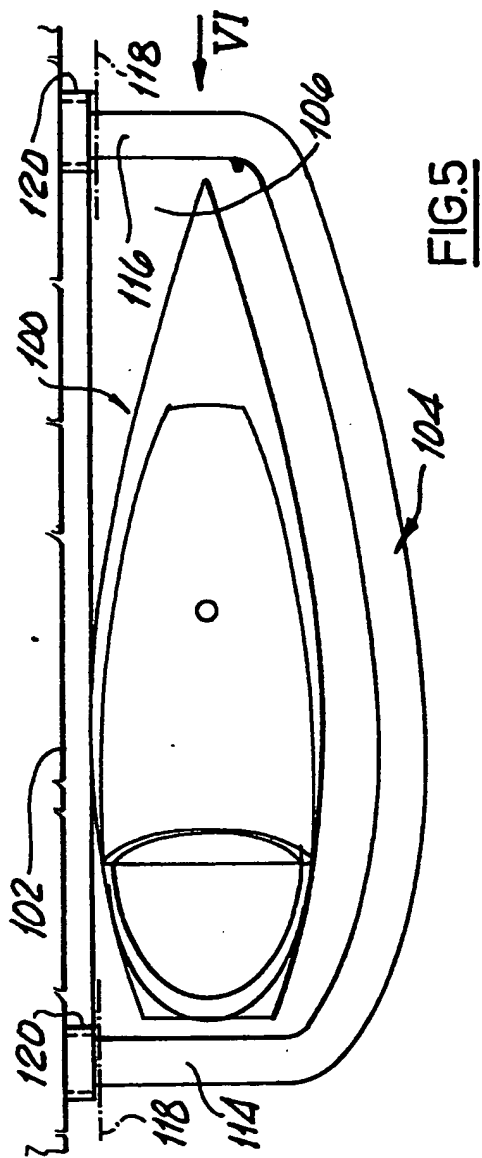
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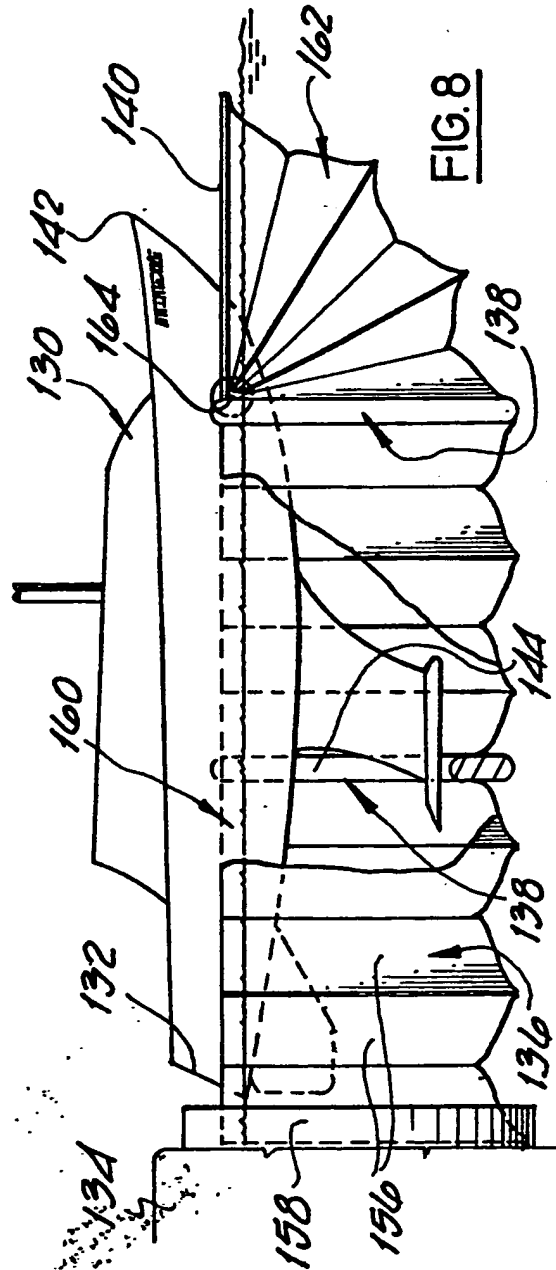
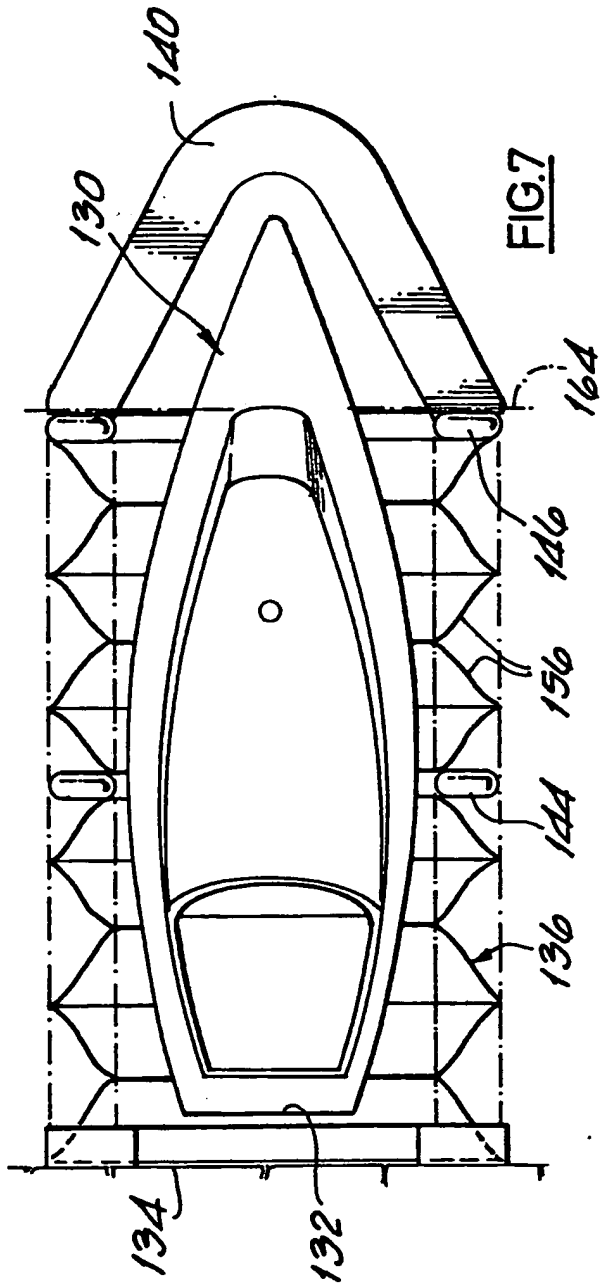
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European Patent  
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# EUROPEAN SEARCH REPORT

Application Number

EP 89 30 8736

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	FR-A-2 129 265 (BLENET) * Pages 2,3; figures 3-5 *	1,2	B 63 B 59/04
A	---	6,10	
A	US-A-4 693 200 (NOBLE) * Abstract; figures 1,2 *	1,6,10	
A	GB-A-1 094 883 (TONKIN) * Page 1; figures 1,2 *	1,6,10	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B 63 B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 11-12-1989	Examiner VISENTIN, M.
<b>CATEGORY OF CITED DOCUMENTS</b> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			